App. No. 10/584,725
Office Action Dated October 30, 2008

## REMARKS

Favorable reconsideration is respectfully requested in view of the following remarks.
Claims 1-5, 9 and 12-19 are pending.

### Claim rejections - 35 U.S.C. § 103

Claims 1-5 are rejected under 35 USC 103(a) as being unpatentable over Jeong et al. (KR 10-2001-0000827) and further in view of Yoshida (US 6,534,801). Applicants respectfully traverse the rejection.

The rejection relies on Yoshida as teaching the proportion of Mg in a sum of Na and Mg to be in a range of 0.1 to 5 mol%. Applicants respectfully submit that the rejection is relying on the improper use of hindsight in the interpretation of the reference.

In particular, Yoshida teaches that in GaN-based HEMT production by the MOCVD method, first, a buffer layer made of GaN is formed, then, an undoped (i-type) GaN layer is formed on the GaN buffer layer, and further, an n-type AlGaN layer is formed on the undoped GaN layer (col. 1, lines 39-46). The reference notes that in such a layer structure, the portion of the n-type AlGaN layer where the gate electrode is formed functions as a source of electrons to be supplied to the undoped GaN layer located below, and to realize high mobility of the electrons from the n-type AlGaN layer, it is necessary that the undoped GaN layer has as few impurities or lattice defects as possible (col. 1, lines 52-63). The reference teaches that in the conventional GaN-based HEMTs, the n-type impurity is effectively doped in the undoped GaN layer due to the great number of lattice defects in the undoped GaN layer formed by the MOCVD method, and as a result, the undoped GaN layer cannot be given a high resistance (col. 1, line 64 to col. 2, line 20). The reference teaches that in their GaN-based HEMT, such problems can be solved by doping a p-type impurity during the layer formation process to compensate the remaining n-type impurity, whereby the effective carrier concentration in the undoped GaN layer decreases (col. 2, lines 23-49 and col. 3, lines 36-43). The reference further teaches that the amount of the p-type impurity to be used is determined by the concentration of the remaining n-type impurity in the undoped GaN layer (col. 3, lines 43-49). In contrast, in claim 1, the amount of Mg to be added is defined as a proportion of Mg to the sum of Na and Mg as opposed to the n-type impurity, the proportion being in the range of 0.1 to 5 mol%. Advantageously, when GaN crystals are prepared as required by claim 1, the amount of nitrogen dissolved in the melt can be increased

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(see, for example, Example 1 on page 13, line 5 to page 14, line 2 of the specification and Figure 7) so as to allow a high growth rate of the crystals and improved reproducibility of the crystal growth (page 3, lines 23-26 of the specification). Nothing in Yoshida provides any reason to expect that the amounts of Mg could be limited relative to Na as required by claim 1 so as to achieve the benefit of superior crystal growth of GaN crystals shown in the present specification.

The rejection contends that it would have been obvious to modify Jeong et al. by optimizing the amount of Mg added to obtain the claimed amount by conducting routine experimentation because the Mg dopant amount is taught by Yoshida to be a result effective variable, and the concentration of Mg is taught by Yoshida, which overlaps the claimed range is known to produce desirable electrical properties. However, Jeong et al. is directed to growing GaN monocrystals and uses Mg as a dopant to change the electrical properties of the crystals, whereas Yoshida uses Mg to improve properties in a completely different system. That is, Yoshida is directed to improving electrical properties of a multi-layered structure that has a distinct set of problems due to the nature of the structure and its manufacturing process. While Yoshida teaches examples of amounts of the p-type impurity that could be used, the amounts are quantified based upon properties that result from the manufacturing process of the multi-layered structure, as opposed to the monocrystals themselves. As such, Yoshida fails to provide any teachings that would lead one of ordinary skill to use the amount of Mg determined in Yoshida's multi-layered structure in Jeong's method of growing GaN monocrystals, much less any reason to limit the amount of Mg relative to Na as required by claim 1 so as to achieve the benefit of superior crystal growth of GaN crystals shown in the present specification.

Claims 1-5, 9 and 15-19 are rejected under 35 USC 103(a) as being unpatentable over Xu (US 2004/0003495) in view of Ivantzov et al. (US 6562124). Applicants respectfully traverse the rejection.

Xu teaches the use of a metal flux that can be added to the gallium melt. The reference teaches that the metal flux may be sodium or lithium or alternatively, Group I and Group II metals (paragraphs [0125] and [0128]). However, the reference teaches that the concentration of the metal flux in the gallium melt is based on the weight of the gallium (paragraph [0130]). In contrast, in claim 1, the amount of Mg to be added is defined as a proportion of Mg to the sum of Na and Mg as opposed to gallium, the proportion being in a range of 0.1 to 5 mol%. Nothing in

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the reference provides any reason to expect that the amounts of Mg could be limited relative to Na as required by claim 1 so as to achieve the benefit of superior crystal growth of GaN crystals shown in the present specification. Accordingly, claim 1·and the dependent claims therefrom are patentable over Xu.

The rejection relies on Ivantoz for the proportion of Mg in a sum of Na and Mg to be in a range of 0.1-5 mol%. Applicants respectfully submit that the rejection is relying on the improper use of hindsight in the interpretation of the reference. As indicated above, Xu teaches that the concentration of the metal flux in the gallium melt is based on the weight of the gallium. Ivantoz merely teaches that GaN ingots containing up to $10^{20}$ cm$^{-3}$ of Mg and Zn were grown. Nothing in the references provides any reason to limit the amount of Mg relative to Na as required by claim 1, much less any reason to expect that the amounts of Mg could be limited relative to Na as required by claim 1 so as to achieve the benefit of superior crystal growth of GaN crystals shown in the present specification.

Claims 12-14 are rejected under 35 USC 103(a) as being unpatentable over Xu in view of Ivantzov et al. and further in view of Yoshida. Applicants respectfully traverse the rejection.

Claim 1 has been distinguished over Xu, Ivantzov and Yoshida above. Claims 12-14 depend from claim 1 and are patentable over the references for at least the same reasons discussed above for claim 1.

In view of the above, favorable reconsideration in the form of a notice of allowance is requested. Any questions or concerns regarding this communication can be directed to the attorney-of-record, Douglas P. Mueller, Reg. No. 30,300, at (612) 455.3804.

Respectfully submitted,

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Dated: January 28, 2009

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